

LOGROLLING IN THE U.S. CONGRESS

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Does exchange, i.e., vote trading, occur in legislatures? If so, is it quantitatively important or optimal? How important are political parties for the organization of logrolling coalitions? To address these questions, this paper investigates a broad range of votes where logrolling has been reported among interests favoring subsidies for urban, labor, and farm interests. The findings suggest that logrolling agreements are widespread, that many Democratic congressmen changed votes because of logrolling agreements, and that the Democratic party served to facilitate logrolling between its members. Furthermore, logrolling coalitions exhibited a strong degree of stability.

I. INTRODUCTION

A long-standing question in political science is whether exchange occurs in legislatures, as it is expected in any economy where the intensity of demand varies. The issue was originally raised by Buchanan and Tullock [1962] and expanded by Coleman [1966] and Mueller [1967]. The subsequent literature has produced numerous models of vote trading (Haefele [1971], Riker and Brams [1973], Koford [1982a]). Much of the work suggests that vote trading leads to chaotic results (see, for example, Riker and Brams [1973], Kramer [1977], and McKelvey [1976]). Currently, vote trading's quantitative importance and optimality are unknown.

References to logrolling go back to the early literature in political science. Bentley [1907] refers to it, and since then scholars such as Mayhew [1966] and Ferejohn [1974] have provided primarily anecdotal evidence for logrolling. The economic analysis of logrolling has mostly been theoretical and little work has been done to assess the qualitative and quantitative importance of vote trading in legislatures.

However, much might be learned from such analysis, given the apparent puzzle that for most roll-calls votes on parts of bills only a minority of districts stand to gain. Yet such proposals get passed.

Until recently vote trading has not been identified empirically. Stratmann [1992] is the only paper that identifies vote trades statistically, and it looks only at vote trades among agricultural interests. However, it would be interesting to know whether logrolling is prevalent in circumstances other than farm commodity programs. We need to identify logrolling coalitions to assess how widespread logrolling agreements are: we expect them to be common if the intensity of demand for legislation varies.

Related to the issue of vote trading is the question of what factors determine congressional voting behavior. Major elements in a legislator's voting decision are constituency interests, ideology, party, and (perhaps) vote trading. One segment of the literature on congressional voting has focused on the role of political parties as an important force determining a legislator's voting decision. Some authors have argued that parties provide an organizational framework within which logrolling will happen (see, for example, Fiorina [1974], Koford [1987], Weingast and Marshall [1988], Johnson and Stratmann

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[1992]). Alternatively, Lindsay and Maloney [1988] suggest that party discipline forces a legislator to vote for or against a piece of legislation. The latter view implies that on some issues party affiliation forces the legislator to vote against constituency interests.¹

Whether party affiliation is a signal to constituencies of one's overall propensity to vote on bills, or a means to build coalitions, or whether both elements are important is an unresolved question. Voting along party lines can be due to party loyalty or party pressure, promoting the interests of one's constituency, or logrolling within the party. To answer questions about voting along party lines and about vote trading and coalitions within a quantitative framework, one has to distinguish empirically between party loyalty and logrolling coalitions that are organized within a party. Empirical studies have typically included a party dummy variable in regression equations. However, if logrolling coalitions are organized within a party, such a dummy variable will measure both potential party loyalty or potential party discipline and membership in a logrolling coalition. This paper uses a different approach to separate the logrolling variable from the party loyalty variable, and so distinguishes between voting for a proposal because of membership in a logrolling coalition organized by a party, and because of potential party discipline.

This paper analyzes a broad range of votes where logrolling has been reported. The analysis spans two Congresses (1959 to 1962) and examines trades between interests favoring subsidies for city interests, labor interests, and farm interests. These roll-call votes were analyzed by Mayhew [1966] in his classic study of congressional behavior.

The first section presents the conceptual model underlying the empirical analysis. The second section discusses the role of parties in logrolling. The empirical model is presented in the third section, the data are discussed in the fourth section, and results are presented in the fifth section. The last section contains conclusions.

II. CONCEPTUAL FRAMEWORK

Legislators trade votes because intensities in preferences over proposals differ and because proposals would not pass if every legislator voted sincerely. In vote trading representative A will vote in favor of a bill that she is mildly opposed to but that is strongly favored by legislator B. In exchange, legislator B will support a bill that he is mildly opposed to but that is strongly favored by A. Suppose a third legislator is opposed to both proposals. In this case neither proposal would pass in the absence of the vote-trading agreement but both will pass if an agreement is made.²

Since Downs [1957] economists have modeled legislators as representing their constituency. Constituency variables are expected to predict and to explain the voting decisions of representatives. For example, legislators from farm districts are predicted to vote for farm subsidies. It is also in the constituency's interest that their representative trades votes on some proposals that the constituency is mildly opposed to, in exchange for votes on proposals the constituency is intensely in favor of. For example, voters from a textile district may prefer that their representative casts a vote in favor of steel interests if this ensures that sufficient votes are cast for a tariff on textiles.³

1. The other reason legislators may vote against their constituencies' interests is because of personal ideology. See Kalt and Zupan [1984].

2. See Bernholz [1973] for a more rigorous representation of vote trading. Mueller [1989] provides a review of the literature on logrolling.

3. See Olson [1965] for a general discussion of the influence of small groups in the political process.

If logrolling is important, one expects logrolling agreements to add to the explanation of the voting decision. One implication is that for members of a logrolling coalition, a vote on one issue can explain the vote on another issue. Thus the voting decision of a legislator can be expressed as

$$(1) \quad V = \alpha_1 + \gamma_1 W + \delta_1 S + \beta_1 X_V + \varepsilon_1$$

where X_V is a vector of constituency variables that influence the vote on issue V , W and S are votes on other issues, and ε_1 is a random normally distributed error term with zero mean and constant variance. For example, for an agreement between interests for tariffs on textiles, on steel, and on sugar, V would represent the vote on textiles, W a vote on steel, and S a vote on sugar. Positive coefficients are predicted on W and S .

Differences in intensities of demand lead legislators to trade votes. Demand among legislators varies because their constituents' interests vary. To ensure that the estimated coefficients on the right-hand-side votes reflect only logrolling and not other factors that affect voting, W and S should not be the actual votes but the predicted votes. Thus equation (1) can be rewritten as

$$(2) \quad V = \alpha_1 + \gamma_1 \hat{W} + \delta_1 \hat{S} + \beta_1 X_V + \varepsilon_1$$

where \hat{W} and \hat{S} are linear combinations of observed constituency variables. A finding that γ_1 and δ_1 are positive and statistically different from zero is consistent with logrolling. If the actual votes instead of the predicted votes were employed in the regression equation, an omitted constituency characteristic that drives the votes on V , W , and S could lead to the erroneous conclusion that a vote trade occurred. The use of the predicted votes ensures that vote trades are correctly identified. Because the predicted votes are linear combinations of observed constituency vari-

ables,⁴ equations similar to equation (2) can be written for the votes on sugar and on textiles:

$$(3) \quad W = \alpha_2 + \gamma_2 \hat{V} + \delta_2 \hat{S} + \beta_2 X_W + \varepsilon_1,$$

$$(4) \quad S = \alpha_3 + \gamma_3 \hat{V} + \delta_3 \hat{W} + \beta_3 X_S + \varepsilon_1.$$

The constituency variables X_W and X_S are variables affecting the voting decision on W and S . Any omitted variables, such as unobserved personal ideology, unobserved constituency interests, logrolling agreements not captured by the right-hand-side variables, or unmeasured party discipline, that affect all three votes will be measured through the correlation between the error terms.

Bernholz [1973] has shown that legislative logrolling implies the potential for cycles. Cycles may occur if vote-trading coalitions are not stable because legislators have an incentive to renege on vote-trading agreements. No incentive exists to keep up the bargain once their issue is voted on (see, for example, Mueller [1967], Riker and Brams [1973]). If logrolling coalitions are unstable, one would expect to find, for example, that steel interests vote for textile interests but that textile interests do not vote for steel interests. Instability in legislatures may be a valid concern if an issue only comes up once, but may not be relevant if issues are voted on repeatedly, as is the case for the issues analyzed in this paper. Legislative vote trading more closely resembles a prisoner's dilemma supergame, with repeated dealing, than a game played only once, because issues are voted on repeatedly (Mueller [1989, 93]).⁵

4. Kau and Rubin [1979] have attempted to examine logrolls on votes on diverse issues. However, their method has the shortcoming that they use a dummy variable for the vote on the right-hand side of the regression equation instead of using the predicted vote.

5. Further, if parties are successful in enforcing vote trades, stable coalitions are expected. See Koford [1987] and Weingast and Marshall [1988].

A successful logroll implies an intense minority in favor of the deal facing a relatively indifferent hostile majority. And we should see a rather small majority in favor of the bills. The intense minority has no incentive to buy more votes than required since only a majority of votes is needed to pass a bill and vote trading is costly. If bills are passed with unanimous support, vote trading is unlikely to have been the motivating force in the passage of the bill. These concepts are used to identify logrolls.

Legislators buy votes to ensure that a bill will win or lose. They are not likely to be interested in trades unless they expect these trades to lead to the desired outcome on the floor. Koford [1982b] suggests logrolling may have occurred on votes where the intense minority has won and the vote margin has been close. In the empirical analysis, votes with a winning margin of less than about one hundred votes are considered close.

Issues involving logrolling promise high benefits to a minority and impose low costs on others and vice versa. The votes analyzed here have this feature. These votes are on housing subsidies, farm subsidies, and issues of interests to labor. Mayhew's [1966] analysis of these votes shows that only a minority of all districts benefited from these programs.

III. THE ROLE OF PARTY

Within the Downsian framework candidates' platforms converge at the preferences of the median voter. If representatives deviate from the preferences of their constituency because of party pressure to vote along party lines, they risk defeat in the following general election.⁶ However, the convergence of platforms at

the median ensures that party affiliation does not matter. This brings into question the purpose parties serve to constituencies and legislators. Peltzman [1984] finds that the characteristics of each party's constituencies are different. Alternatively, Johnson and Stratmann [1992] argue that parties facilitate logrolling agreements among representatives from similar constituencies.

Mayhew [1966] gives plenty of examples where members of Congress voted on proposals along party lines even though the benefits of the proposals accrued to only a minority of one party. He suggests that between 1948 and 1962 the Democratic party was instrumental in organizing vote-trading coalitions among its members. Mayhew reports that a minority of all legislators were interested in farm issues, labor issues, and city issues. If each legislator voted according to her true preferences, a vote for subsidies for each special interest would have failed. However, most of the farm, labor, and city districts were represented by Democrats, and Mayhew claims the Democratic party was instrumental in organizing a vote-trading coalition between these interests that ensured benefits for the noted special interests. Others have also argued that the Democratic party was an important force in organizing logrolling coalitions in that time period (see, for example, Froman [1967], Jackson [1974]).

It is easier for the majority party to organize successful vote trades within the party; even if members of the minority party traded votes among themselves, this would not assure the passage of the proposals (Johnson and Stratmann [1992]). The Democrats were the majority party in the House of Representatives during the 1950s and 1960s, and anecdotes exist about logrolling within the Democratic party for the issues and the time periods analyzed in this paper. If these trades were organized primarily between members of the Democratic party, then we expect pri-

6. Similarly, individual ideology plays no role in the voting decision of a representative within the Downsian model. If a legislator voted his own ideology, the model predicts that he would lose to the challenger in the next election.

marily Democratic representatives to have switched their vote due to membership in a logrolling coalition and that Democrats were the primary beneficiaries of bills that required vote trades for their passage.

Previous studies have included a dummy variable for party affiliation in regression equations and also have included an ideological rating by interest groups as, for example, Americans for Democratic Action. However, there is little theoretical justification for the inclusion of these variables. The Downsian model predicts that legislators act according to the interests of their constituency and that platforms of parties converge at the preferences of the median voter. Thus personal ideology and party affiliation should not matter. However, studies have found statistically significant effects of these variables on congressional voting (see, for example, Kau, Keenan, and Rubin [1982]).

It is unclear what the party dummy variable and ideological rating measure. Existence of vote-trading coalitions can explain that statistically significant effects are found on the aforementioned variables. Suppose parties organize logrolling coalitions, and logrolling occurs primarily within the Democratic party, as has been suggested for the 1950s and 1960s. In this case, a dummy variable for Democrats is a variable measuring membership in logrolling coalitions. Similar reasoning holds for ideological ratings since these ratings are based on voting records. This suggests that the position that rating variables measure logrolling agreements is at least as convincing as arguing that rating variables reflect ideology. For example, a liberal group favoring subsidies to lower income groups would rate a southern farm representative high on the liberal scale, if this representative is in a logrolling coalition with legislators favoring subsidies for public housing and legislators favoring increases in the minimum wage. The reason the legislator is ranked highly is not because of his or her personal ideology

or district interests but simply because of membership in a logrolling coalition.

These considerations may be of secondary importance for studies that are not focusing on logrolling and the role of parties in forming logrolling coalitions. For example, in studies that analyze the effects of campaign contributions on congressional voting, ideological ratings may be useful as a proxy for logrolling coalitions. The goal of this study is, however, to identify logrolling among certain interests within a party; therefore a party dummy variable is not useful to analyze logrolling between specific interests within one party. A party dummy variable would simply confound the analysis of what kind of special interest is trading with another special interest.

Thus ideology and party discipline may be important in a legislator's voting decision, but inclusion of a party dummy variable or an ideological rating in the regression equation is problematic. Therefore, ideology and party discipline are accounted for here via a correlation of the error terms in the system of regression equations. If party discipline and unobserved ideology are important in roll-call votes and work in the same direction, one expects a positive correlation between the error terms.

This paper analyzes some of those votes where logrolling has been reported within a rigorous statistical framework. It provides a quantitative analysis as to whether a vote-trading agreement existed and whether membership in a logrolling coalition motivated Democrats to vote for special interests or whether party discipline and other factors were the motivating forces. If it is found that the logrolling coefficients are all zero, then it would seem that it was not logrolling that motivated congressmen to vote along party lines. Highly and positively correlated errors indicate that the same unobserved variables motivated the voting decisions of Democrats and Republicans.

IV. ECONOMETRIC MODEL

Since logrolling occurs over a series of votes, a simultaneous three-equation probit model is specified. The model allows for a correlation of the error terms and endogenizes the latent variables. It draws on techniques suggested by Ashford and Sowden [1970], Amemiya [1974], and Mallar [1977]. The model is estimated by full information maximum likelihood.

Let y_{1i} , y_{2i} , and y_{3i} be dichotomous variables indicating the voting decision of a legislator i on three different votes, and let x_{1i} , x_{2i} , and x_{3i} be vectors of observations on his or her constituency characteristics. A three-equation model that allows for the simultaneous determination of the voting decisions can be written as

$$\begin{aligned} y_{1i}^* &= \gamma_{12}y_{2i}^* + \gamma_{13}y_{3i}^* + \beta_1x_{1i} + \varepsilon_{1i} \\ y_{2i}^* &= \gamma_{21}y_{1i}^* + \gamma_{23}y_{3i}^* + \beta_2x_{2i} + \varepsilon_{2i} \\ y_{3i}^* &= \gamma_{31}y_{1i}^* + \gamma_{32}y_{2i}^* + \beta_3x_{3i} + \varepsilon_{3i} \end{aligned}$$

(5) $i = 1, \dots, n.$

Since y_1 , y_2 and y_3 are binary, we have

$$\begin{aligned} y_{ji} &= 1 \text{ if } y_{ji}^* > 0 \\ y_{ji} &= 0 \text{ if } y_{ji}^* \leq 0 \end{aligned}$$

(6) $j = 1, \dots, 3$

where y_{ji}^* is the net benefit a legislator receives from voting on a piece of legislation. The disturbances capture unobserved variables that influence a legislator's voting decision. The errors ε_{ji} are distributed $N(0,1)$ with $E(\varepsilon_{1i}, \varepsilon_{2i}) = \rho_{12}$, $E(\varepsilon_{1i}, \varepsilon_{3i}) = \rho_{13}$, and $E(\varepsilon_{2i}, \varepsilon_{3i}) = \rho_{23}$. As suggested by Mallar [1979] the votes on the right-hand side of (5) are estimated by

$$(7) \quad y_{ji} = \beta_j x_{ji} + v_{ji} \quad j = 1, \dots, 3.$$

Therefore, the right-hand-side vote variables are the predicted indices when only constituency variables are used to explain the voting behavior. This specification is consistent with the model represented in equations 2, 3, and 4. Each coefficient in the system of equations in (5) is identified since some constituency variables in one vote equation do not appear in any of the remaining vote equations.⁷

If I used the observed dichotomous vote variables on the right-hand side of equation 5, I would have no confidence that the estimated coefficients measured logrolling. Besides logrolling, these coefficients would also measure other unobserved variables, for example ideology, that make the legislator favor or oppose all three issues considered. Since predicted vote indexes are used in the estimation process, this study is not subject to the criticism Jackson and Kingdon [1992] levy against studies that use ideological ratings in vote regressions. The estimated coefficients in equation 5 unambiguously reflect logrolling if legislators' personal ideologies are orthogonal to constituency interest in the equations used to estimate the predicted votes. In particular, if personal ideology for government spending (measured by an ADA residual, for example) were correlated with the explanatory variables in the equations used to estimate the predicted votes, then the logrolling coefficients could be interpreted to reflect, in part, ideological voting. The finding that the logrolling coefficients are not statistically significant when no vote trades are predicted (on lopsided bills and bills where the intense minority lost) enhances our confidence that the estimated vote-

7. For the form of the likelihood function and for a more detailed motivation for the use of this statistical model to detect logrolling see Stratmann [1992]. A GAUSS program to evaluate the likelihood function is available from the author upon request.

trading coefficients reflect logrolling and not unobserved ideology (Stratmann [1992]).

V. DATA AND ECONOMETRIC SPECIFICATION

Mayhew [1966] reports the presence of logrolling coalitions between urban, farm, labor, and western interests for the time period he analyzed. This study focuses on vote trading between the first three interests.⁸

Anecdotal evidence for the presence of a logrolling coalition comes from a statement on the House floor by the city representative Alfred Santangelo of Manhattan: "I say you Members from the farm states whom we have supported time and time again that this policy of government aid is a two-way street. We want you to support us to the same extent we supported you" (Mayhew [1966, p. 81]). Mayhew states, "the Democratic party in these years (1947-1962) was transcendently a party of 'inclusive' compromise...Some congressmen wanted...area redevelopment funds, others wanted housing projects, still others wanted farm subsidies. As a result, the House Democratic leadership could serve as an instrument for mobilizing support among all Democrats for the programs of Democrats with particular interests. 'Indifferent' Democratic congressmen frequently backed such programs 'even against the debatable best interests of the people of their own communities'" (Mayhew, p. 150). Though Mayhew suggests that logrolling may have occurred, Democrats voting with other Democrats may also have been due to party pressure or party loyalty as indicated by the title of his book "Party Loyalty among Congressmen." This study in-

vestigates the extent to which vote-trading agreements, purged of party loyalty or party pressure, helped the passage of bills providing subsidies for special interests.

I analyze two sets of roll-call votes from the 86th Congress (1959-1960) and two sets of roll-call votes from the 87th Congress (1961-1962). Each set of votes contains three roll-call votes each. The selection of the votes was guided by Mayhew's [1966] study in which he suggested the presence of logrolling coalitions for the passage of these votes.

The farm vote in the first set of votes selected for the 86th Congress curtailed the wheat price support program. This amendment was defeated 224 to 141. The city vote cut authorization for the Housing Act of 1959. This amendment was defeated 234 to 189. In the second set of votes, the farm vote implemented the tobacco price support program (250-149). The city vote allocated funds for public housing and urban renewal (241-177). For both sets of votes the labor vote chosen is a vote to authorize loans and grants to depressed areas (202-184).

Two sets of roll-call votes from the first session of the 87th Congress were analyzed. The farm vote utilized in both sets of votes is a vote on an amendment calling for a reduction in the appropriations for the Department of Agriculture. This amendment was defeated 196 to 184. In the first set of votes the city vote is on the passage of the Housing Act of 1961 (235-178). The labor vote is on the House version of the Area Redevelopment Act (251-167). In the second set of votes the labor matter is on the adoption of the conference report of the Area Redevelopment Act (224-193), and the city vote is on the authorization of \$4.88 billion in housing programs (229-176). The numbers of these votes corresponding to the numbers in various issues of the *Congressional Quarterly Almanac* are given in the data appendix. In the statistical analysis the vote was coded to equal one if the vote benefited

8. According to Mayhew's definition, a vote is of western interest whenever the vote is on a specific issue concerning a particular western district, as, for example, the building of a dam. In this study, western interests are not focused on because of lack of availability of good constituency variables.

farm, city, or labor interests. If a legislator paired for (against), the vote was counted as a yes (no) vote.

Mayhew's explanatory variables are used to identify constituency interests of members of Congress. Farm votes are explained by number of farms in a congressional district (*FARMER*), agricultural income by state (*AGINC*), this variable squared (*AGINC2*), and a dummy variable for members of Congress coming from one of the eleven old confederate states (*SOUTH*). On the first two variables a positive sign is expected and a negative sign is expected on agricultural income squared. Mayhew argues that southern states had a strong interest in agricultural legislation. Thus, a positive sign on *SOUTH* is predicted. City votes, the term used to describe votes on housing subsidies, are explained by the percent of homes that are rented in a congressional district (*RENT*), the degree of urbanization (*URBAN*), and *SOUTH*. The predicted sign on the first two variables is positive. Mayhew reports that southern Representatives voted for farm interests but often voted against other subsidies for special interests. Thus, I expect a negative sign on *SOUTH* in city votes. Labor votes are explained by the percent of blue collar workers in a congressional district (*BLUEC*), and the rate of unionization by state (*UNION*), this variable squared (*UNION2*), and *SOUTH*. The expected signs on *BLUEC* and *UNION* are positive. The expected signs on *UNION2* and *SOUTH* are negative. The coefficients on the variables measuring logrolling, as specified in the econometric model in the previous sections, are positive. Means and standard deviations of the explanatory variables are presented in Table I.

The votes analyzed were cast predominantly according to party lines. For most votes, about 80 percent of the Democrats opposed about 80 percent of the Republicans. The constituency data reflect the differences in the makeup of the typical

Democratic legislator's constituency and that of the typical Republican legislator.⁹ For example, from the 120 districts with the greatest number of farms, renters (public housing interests), and blue collar workers (labor interests), for these three categories, 25, 20, and 33 districts were represented by a Republican. Therefore, most of the districts that benefited primarily from farm, city, and labor legislation were represented by Democrats.¹⁰

VI. RESULTS

The results from the 86th Congress's votes are presented in Table II. In the farm, city, and labor votes the constituency variables have the predicted signs and are statistically significant. Legislators are more likely to vote for farm interests the larger the number of farms in a congressional district. State income in agriculture has the predicted positive effect and the effect is declining at the margin.¹¹ Representatives are more likely to vote for housing subsidies the more urbanized their constituency and the larger the share of renters in their congressional district. Legislators with a higher percentage of blue collar workers in their constituency and legislators who come from a state with a higher degree of unionization are more likely to vote in favor of labor interests. Southern representatives are more likely to vote for farm subsidies but less likely to vote for housing subsidies and legislation favoring labor interests.

9. This finding is consistent with the arguments presented by Peltzman [1984] and Johnson and Stratmann [1992].

10. Mayhew [1966] suggests that if every legislator voted in line with narrowly defined constituency preferences, only a minority of legislators would have voted for farm, city, or labor interests. He identified 111 farm districts, 140 city districts, and 128 labor districts.

11. A nonlinear form of the constituency variables that were available by district were tried in the regression analysis. However, the results suggested that these variables are linear and not nonlinear in the voting decisions of legislators.

TABLE I
Means and Standard Deviations

Variable	Mean (Std. Dev.)	Units of Measurement
FARMER	0.8408 (0.9128)	Number of farms in 10,000
AGINC	1.9447 (1.8308)	1959 income in agriculture by state in 100 dollars
AGINC2	7.1260 (17.1270)	AGINC squared
URBAN	3.2156 (3.3759)	Percent urbanization/10
RENT	3.8386 (1.5534)	Percent of nonowner-occupied housing/10
BLUEC	4.9376 (0.9583)	Percent of blue collar workers/10
UNION	3.0460 (1.0473)	Percent of unionization by state/10
UNION2	10.3726 (6.0475)	UNION squared
SOUTH	0.2414 (0.4284)	South=1, Non-South=0

All of the six logrolling coefficients have the predicted positive signs and are statistically significant. The estimates indicate a stable coalition where logrolling contracts are honored. The findings suggest that farm, city, and labor representatives have formed a logrolling coalition that helped the passage of the bills each group was interested in.

Seventy-one legislators switched votes because of membership in the logrolling coalition in the farm vote.¹² In the city vote

135 legislators and in the labor vote 58 legislators switched their vote because of membership in the logrolling coalition. Labor interests and city interests would have lost the votes in the absence of logrolling. In each vote the number of Democrats who switched their vote due to a logrolling agreement outweighed the number of Republicans. For example, in the farm vote, sixty-one of the seventy-one legislators who switched their vote were Democrats.

The estimated correlation coefficients between the error terms of the farm and labor equations (r) is 0.95. The other two estimated correlation coefficients are of similar magnitude. The high and positive correlations among the unobserved variables indicate that the same unobserved

12. If the probability of voting for special interests was less than 0.5 for a certain representative when the logrolling variables were left out of the vote equation, and if for this legislator the probability increased to above 0.5 when the logrolling variables were included, then I counted the representative as a legislator who switched his or her vote because of membership in a logrolling coalition.

TABLE II
Votes in 1959-60
First Set
Simultaneous Equations Model
Parameter Estimates and Asymptotic Standard Errors

	FARM	CITY	LABOR
INTERCEPT	-1.3700 (0.2300)	-1.4700 (0.2900)	-4.7900 (0.7600)
FARMER	0.4300 (0.1000)		
AGINC	0.5700 (0.1300)		
AGINC2	-0.0530 (0.0130)		
URBAN		0.0600 (0.0220)	
RENT		0.3500 (0.0700)	
BLUEC			0.6000 (0.1000)
UNION			1.3000 (0.4000)
UNION2			-0.2000 (0.0600)
SOUTH	2.2700 (0.2900)	-1.5500 (0.4500)	-2.1200 (0.5200)
FARM		1.4800 (0.3600)	1.4400 (0.3600)
CITY	0.4500 (0.1500)	0.8800 (0.2200)	
LABOR	0.8700 (0.2100)	1.1100 (0.2400)	
LOGLIKE	ρ_{FC}	ρ_{FL}	ρ_{CL}
-457.02	0.9700 (0.0200)	0.9600 (0.0200)	0.9500 (0.700)

factors influenced the votes of the representatives. Among these factors are unobserved constituency variables, ideology, omitted logrolling variables, and party discipline. Measured logrolling agreements have an important effect on a legislator's voting decision regardless of the nature of the unobserved variables. The

high positive correlation can be interpreted to mean that party loyalty is a large part of what accounts for the high correlations. However, the high positive correlations are consistent with the view that party is a brand name under which like-minded candidates and voters gather and that, therefore, the high positive correla-

TABLE III
Votes in 1959-60
Second Set
Parameter Estimates, Covariances, and Asymptotic Standard Errors

Right-hand variable	Equation		
	FARM	CITY	LABOR
Logrolling Parameter Estimates			
FARM	—	0.5900 (0.1900)	0.8500 (0.2000)
CITY	0.5800 (0.1700)	—	1.0000 (0.2800)
LABOR	0.5500 (0.2400)	1.1400 (0.2500)	—
Covariances			
FARM	1.0	—	—
CITY	0.7800 (0.0800)	1.0	—
LABOR	0.8100 (0.0600)	0.9400 (0.1700)	1.0

tions reflect unobserved constituency interests (Peltzman [1984]). Also, the positive correlations may reflect that Democratic western congressmen were part of the logrolling. They gained water projects in exchange for votes for farm, city, and labor interests.

The estimated coefficients on the constituency variables for the second set of votes in the 86th Congress are very similar to the previous estimates. Here, only the estimated logrolling correlation coefficients, and standard errors are reported (Table III). Again, the logrolling coefficients are statistically significant. Here, a pattern of symmetry is apparent between city interests and labor interests and between farm and city interests. The coefficients of the labor vote in the city equation and the city vote in the labor equation are the largest. The estimated correlation coefficients are smaller than in the previous

sets of votes, but still positive and relatively large.

Table IV reports the results for the first set of votes in 1961. The results confirm the presence of a logrolling coalition. The labor vote in the farm equation is statistically significant at the 10 percent level and all other votes are statistically significant at the 5 percent level. Relative to the estimates for the previous Congress, the correlation coefficients are lower between the farm and city equations (0.44 versus 0.97) and the farm and labor equations (0.38 versus 0.96). The logrolling and correlation coefficients for the second set of votes for the 87th Congress are very similar to the first set (Table V). In this vote, membership in the logrolling, coalition turned a no vote into a yes vote for 21 legislators in the farm vote, 146 legislators in the city vote, and 79 legislators in the labor vote. As in the previous votes, the

TABLE IV
Votes in 1961-62
First Set
Simultaneous Equations Model
Parameter Estimates and Asymptotic Standard Errors

	FARM	CITY	LABOR
INTERCEPT	-1.8700 (0.2600)	-1.3600 (0.2800)	-3.4100 (0.8400)
FARMER	0.9100 (0.1100)		
AGINC	0.6700 (0.1400)		
AGINC2	-0.0690 (0.0130)		
URBAN		0.0850 (0.0270)	
RENT		0.3000 (0.0700)	
BLUEC			0.5600 (0.1200)
UNION			6.2000 (2.9000)
UNION2			-1.100 (0.4700)
SOUTH	1.2900 (0.2700)	0.0200 (0.2400)	-0.8100 (0.2900)
FARM		0.3500 (0.1400)	0.3400 (0.1400)
CITY	0.3600 (0.1400)		0.8700 (0.2100)
LABOR	0.4700 (0.2700)	1.3100 (0.3000)	
LOGLIKE	ρ_{FC}	ρ_{FL}	ρ_{CL}
-533.33	0.4400 (0.1000)	0.3800 (0.1000)	0.9400 (0.1600)

majority of legislators who switched their votes were Democrats.

To some extent the size of the correlation coefficients reflects how many votes are needed to get a majority. The correlations capture unobserved vote-trading agreements that, for example, western legislators made with city, farm, and labor interests. The more trades required, and the more trades consequently made, the

larger the estimated correlation coefficients. The cause of the relatively low correlations between farm votes and other issues, for example, in Table V may be that only few extra votes (21) were needed for a majority.

If logrolling coalitions were organized within the Democratic party, one expects that representatives who have the propensity to naturally switch from a no vote to

TABLE V
 Votes in 1961
 Second Set
 Parameter Estimates, Covariances, and Asymptotic Standard Errors

Right-hand variable	Equation		
	FARM	CITY	LABOR
Logrolling Parameter Estimates			
FARM	—	0.3600 (0.1500)	0.3800 (0.1400)
CITY	0.3500 (0.1300)	—	0.8000 (0.2000)
LABOR	0.5500 (0.3000)	1.4400 (0.3000)	—
Covariances			
FARM	1.0	1.0	
CITY	0.5300 (0.1000)		
LABOR	0.3700 (0.1000)	0.9800 (0.1700)	1.0

a yes vote are more likely to switch when they are Democrats. I define a legislator who is likely to switch as someone whose probability to vote for the measure in the absence of logrolling is between 0.3 and 0.49. Table VI shows the results of this test. The first column shows the number of Democrats (Republicans) whose estimated probability to vote for the measure in the absence of logrolling is between 0.3 and 0.49. Column 2 shows that, with two exceptions, more Democrats than Republicans are predicted to switch their votes as a result of vote trades. Of those who actually switched their votes, Democrats did always outnumber Republicans. Further, the number of Democrats (Republicans) who actually voted for the measure is always larger (smaller) than the predicted switchers. This is consistent with the view that other underlying variables, that are either unobserved or omitted from the empirical model, motivate mem-

bers from the two parties to vote differently.

VII. CONCLUSIONS

Logrolling has been a dominant issue in the economic analysis of legislatures and the political process. However, little has been known about whether logrolling is quantitatively important for legislative decision making. No empirical study has analyzed whether logrolling occurs—not only within a narrowly defined area like agriculture, but whether it also extends to differing policy areas.

This paper finds that logrolling plays an important role for diverse policy areas of legislative decision making. The findings suggest that logrolling agreements are widespread, and this conclusion is consistent with economic theory which predicts that trades are made when the intensity of demand varies.

TABLE VI
Actual Changed Votes

	No Logrolling (1)	Logrolling (22)	Actual Votes (3)	Percent (2)/(1)	Percent (3)/(1)
REPUBLICANS					
First Set: 1961-62					
FARM	18	2	5	0.11	0.28
CITY	98	47	15	0.48	0.15
LABOR	37	15	5	0.41	0.14
Second Set: 1961-62					
FARM	20	6	5	0.30	0.25
CITY	55	33	7	0.60	0.13
LABOR	32	12	3	0.38	0.09
DEMOCRATS					
First Set: 1961-62					
FARM	9	1	6	0.11	0.67
CITY	96	48	77	0.50	0.80
LABOR	52	29	41	0.56	0.79
Second Set: 1961-62					
FARM	14	8	10	0.57	0.71
CITY	100	70	80	0.70	0.80
LABOR	64	50	49	0.78	0.77
REPUBLICANS					
First Set: 1959-60					
FARM	26	4	1	0.15	0.04
CITY	81	43	10	0.53	0.12
LABOR	37	19	4	0.51	0.11
Second Set: 1959-60					
FARM	25	2	1	0.08	0.04
CITY	91	55	10	0.60	0.11
LABOR	39	21	5	0.54	0.13
DEMOCRATS					
First Set: 1959-60					
FARM	38	27	33	0.71	0.87
CITY	82	57	78	0.70	0.95
LABOR	36	24	34	0.67	0.94
Second Set: 1959-60					
FARM	33	21	23	0.64	0.70
CITY	116	80	101	0.69	0.87
LABOR	28	20	28	0.71	1.00

The primary beneficiaries of the special-interest legislation on farm, city, and labor issues were members of the Democratic party. Vote-trading agreements were made within that party, and thus it served as an instrument to facilitate logrolling between its members. This paper isolated the effect of logrolling from that of party pressure. Potential party pressure was accounted for via the correlation in the error terms, and the logrolling variable was thereby purged of party loyalty. The results suggest that many members of the Democratic party supported their fellow legislators because of logrolling agreements.

APPENDIX Data Sources

Roll-call votes: Data on roll-call votes were obtained from data tapes. The numbers of the votes corresponding to various issues of the *Congressional Quarterly Almanac* are for 1959, #22, #23, #36, #37, for 1960, #36, and for 1961, #18, #22, #35, #47, and #51.

FARMER: *Congressional District Data Book*, Districts of the 87th Congress, U.S. Department of Commerce, Bureau of the Census, Washington, D.C., 1961. The *Congressional District Data Book* does not list the number of farms for congressional districts that were not whole-county districts. For the districts that were not listed, the number of farms was computed using county-level data.

AGINC: *Agricultural Statistics* 1959, United States Department of Agriculture.

URBAN: *Congressional Quarterly Weekly Report*, February 2, 1962.

RENT: *Congressional District Data Book*, Districts of the 87th Congress, U.S. Department of Commerce, Bureau of the Census, Washington, D.C., 1961.

BLUEC: *Congressional Quarterly Weekly Report*, July 20, 1956.

UNION: Troy, Leo, *Distribution of Union Membership among the States: 1939 and 1953*, Occasional Paper 56, New York: National Bureau of Economic Research Inc., 1957.

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